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| **Joint Collaborative Team on Video Coding (JCT-VC)**  **of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11**  7th Meeting: Geneva, 21-30 Nov, 2011 | Document: JCTVC-G109  WG11 Number: |

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| *Title:* | **On Intra Mode Mapping** | | | |
| *Status:* | Input Document to JCT-VC | | | |
| *Purpose:* | Proposal | | | |
| *Author(s) or Contact(s):* | Ximin Zhang  Shan Liu Shawmin Lei  2860 Junction Ave.  San Jose, CA95134, USA | *Emails:* | ximin.zhang@mediatek.com shan.liu@mediatek.com shawmin.lei@mediatek.com |
| *Source:* | MediaTek USA Inc. | | | |

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# Abstract

This contribution proposes a unified single mapping method for Intra mode mapping, when the neighboring predictor mode is not allowed for the current Intra prediction unit. Experimental results report negligible impact on BD-rate (0.0x% increase in average) and encoding and decoding runtime. Software and coding procedures are simplified.

1. Introduction

In HEVC each picture is divided into a set of square coding units (CU). Intra and Inter prediction is applied on each coding unit. In current HM(4.0), each Intra coded CU can be treated as a single prediction unit (PU) or divided into four square PUs. Under the current common test condition, the Intra PU size can be 64x64, 32x32, 16x16, 8x8 and 4x4.

For 64x64 PU, 4 prediction modes can be selected; for 4x4 PU, 18 prediction modes can be selected; for 32x32 PU, 16x16 PU and 8x8 PU, 35 prediction modes can be selected. Basically, the modes can be selected by a 64x64 PU is a subset of the modes can be selected by a 4x4 PU and the modes can be selected by a 4x4 PU is a subset of the modes can be selected by a 32x32, 16x16 and 8x8 PU. In order to achieve better compression efficiency, a most-probable-modes (MPM) based scheme is used to encode the mode syntax. Simply speaking, the prediction mode of the top neighbor PU of current PU and the prediction mode of the left neighbor PU of current PU are selected as the most probable modes. If the prediction mode of the current PU is the same as either of the most probable modes, a shorter code word is used to encode the current mode. Otherwise, a longer code word is used. Based on this scheme, up to 35 modes can be the most-probable-modes. If the current PU is 64x64, only 4 modes can be selected. If the current PU is 4x4, only 18 modes can be selected. Therefore, a mapping table is proposed to map the 35 modes to the 4 modes used in 64x64 PU, and map the 35 modes to the 18 modes used in 4x4 PU. In order to consider the future expansion, the mapping table also includes the mapping to 128x128 square unit and 2x2 unit. The size of the table is 140 Bytes.

# Proposed Method

In this contribution, we propose a unified single mapping method for Intra mode mapping. That is, if a neighboring predictor mode is not allowed for the current Intra PU, it is mapped to PLANAR mode, regardless of the size of current PU and the neighboring predictor PU. In this way, the tables and TLU (table look up) process can be removed and thus, both software and coding procedures can be simplified. Experimental results report very small BD-rate increase and negligible encoding and decoding runtime change, as shown in Table 1.

We also investigated an alternative approach which maps mode 18-34 to mode 0-17, when the neighboring predictor Intra PU allows 35 prediction modes and the current Intra PU allows 18 prediction modes, as shown in Equation 1.

MAPPING[17] = {10,4,5,5,1,1,6, 6,7, 4,8,8,2,2,9,9,10} (1)

All other cases (i.e. current PU allows less than 18 modes) use the above single mapping method. Experimental results report negligible impact on both BD-rate and encoding and decoding run-time, as shown in Table 2.

# Experimental Results

Simulations were conducted following common test conditions defined in JCTVC-F900 [1]. Anchor data was generated using HM4.0 software [2]. Results for the proposed unified single Intra mode mapping are shown in Table 1. Results for the alternative approach are shown in Table 2.

Table 1 Results for the proposed unified single Intra mode mapping.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **All Intra HE** | | | **All Intra LC** | | |
|  |  | Y | U | V | Y | U | V |
|  | Class A | 0.0% | 0.0% | 0.1% | 0.0% | 0.0% | 0.0% |
|  | Class B | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% |
|  | Class C | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
|  | Class D | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 0.1% |
|  | Class E | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
|  | **Overall** | 0.0% | 0.0% | 0.1% | 0.0% | 0.1% | 0.1% |
|  |  | 0.0% | 0.1% | 0.1% | 0.0% | 0.1% | 0.1% |
|  | Enc Time[%] | 99% | | | 98% | | |
|  | Dec Time[%] | 100% | | | 100% | | |

Table 2 Results for the alternative approach (35-to-18 mapping; single mapping otherwise)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **All Intra HE** | | | **All Intra LC** | | |
|  | Y | U | V | Y | U | V |
| Class A | 0.0% | -0.1% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class B | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class C | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class D | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Class E | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Overall** | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
|  | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Enc Time[%] | 100% | | | 99% | | |
| Dec Time[%] | 100% | | | 100% | | |

# Conclusions

In this contribution, a unified single mapping method was proposed for Intra mode mapping. Experimental results report negligible impact on BD-rate (0.0x% increase in average) and encoding and decoding runtime. Software and coding procedures are simplified. It is recommended to adopt the proposed method in HM.

# References

1. Frank Bossen, “Common test conditions and software reference configurations”, JCTVC-F900, Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T VCEG and ISO/IEC MPEG, Torino, Italy, July 2011.
2. HM 4.0 Software, <http://hevc.kw.bbc.co.uk/trac/browser/tags/HM-4.0>.

# Patent rights declaration(s)

**MediaTek Inc. may have IPR relating to the technology described in this contribution and, conditioned on reciprocity, is prepared to grant licenses under reasonable and non-discriminatory terms as necessary for implementation of the resulting ITU-T Recommendation | ISO/IEC International Standard (per box 2 of the ITU-T/ITU-R/ISO/IEC patent statement and licensing declaration form).**